Standard 1

Number Sense and Computation

CORE STANDARD

Number Sense and Computation

Exponents

Use whole number exponents for repeated multiplication. Use scientific notation for large numbers.

[Standard Indicators: 7.1.1, 7.1.2]

Proportions and Percents

Use proportions and percents to solve application problems involving the increase of a quantity and the decrease of a quantity. Solve problems involving percents, ratios, rates and similar triangles.

[Standard Indicators: 7.1.8, 7.1.9]

Multiplication and Division with Fractions and Decimals

Understand and perform multiplication and division with negative decimals and fractions.

[Standard Indicator: 7.1.7]

7.1.1 Read, write, compare and solve problems using whole numbers in scientific notation.

Example: Write 300,000 in scientific notation.

7.1.2 Recognize and compute whole number powers of positive integers.

Example: $3^5 = 3 \times 3 \times 3 \times 3 \times 3 = \square$

7.1.3 Recognize the prime factors of a number and find the prime factorization of whole numbers. Write the results using exponents.

Example: $24 = 2 \times 2 \times 2 \times 3 = \square$

7.1.4 Recognize or use prime and composite numbers to solve problems.

Example: A counterexample is an example showing that a statement is not true. Find a counterexample for the statement "All even numbers are composite numbers" and explain how you know it is a counterexample.

7.1.5 Recognize and use the inverse relationship between squaring and finding the square root of a perfect square integer.

Example: Find the area of a square with 5-cm sides and find the side of a square whose area is 144 square cm.

7.1.6 Identify, write, rename, compare and order rational and common irrational numbers and plot them on a number line.

Example: Write in order from smallest to largest: -2, -2π, $-\sqrt{2}$, $-2\sqrt{2}$.

7.1.7 Solve problems that involve multiplication and division with integers, fractions, decimals and combinations of the four operations.

Example: The temperature one day is 5°. It then falls by 3° each day for four days and, after that, rises by 2° each day for three days. What is the temperature on the last day? Explain your method.

7.1.8 Solve problems involving percents.

- Find the whole given a part and the percent.
- Find the percent increase or decrease.

Example: The population of a country was 36 million in 1990 and it rose to 41.4 million during the 1990s. What was the percent increase in the population?

7.1.9 Solve problems involving ratios and proportions.

- Given their ratio, express one quantity as a fraction of another and vice versa.
- Given their ratio, find how many times one quantity is as large as another and vice versa.
- Given the two quantities, express one quantity as a fraction of another.
- In a given ratio, find the whole, or one part, when a whole is divided into parts.
- Solve problems involving two pairs of equivalent ratios.

Example: On a survey of females in an exercise class, 12 out of the 20 females in the class indicated they prefer to exercise in the morning. What percent of the females in the class prefer to exercise in the morning?

Standard 2

Algebra and Functions

CORE STANDARD

Algebra and Functions

Expressions

Evaluate numerical expressions and simplify algebraic expressions involving rational and irrational numbers.

[Standard Indicators: 7.2.1, 7.2.3]

Linear Equations

Write and solve two-step equations and inequalities in one variable.

[Standard Indicators: 7.2.1, 7.2.2]

Graphs of Lines

Find the slope of a line from its graph and relate the slope of a line to similar triangles. Draw the graph of a line given either its slope and one point on the line or two points on the line. Graph proportional relationships and identify the unit rate as the slope of the related line.

[Standard Indicators: 7.2.5, 7.2.6, 7.2.7]

7

7.2.1 **Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description.**

Example: Using symbols, write the following inequality: five less than twice the number is greater than 42.

7.2.2 **Write and solve two-step linear equations and inequalities in one variable.**

Example: Solve the equation $4x - 7 = 12$ and check your answer in the original equation.

7.2.3 **Evaluate numerical expressions and simplify algebraic expressions involving rational and irrational numbers.**

Example: Simplify $3(4x + 5x - 1) + 2(x + 3)$. Explain each step you take.

7.2.4 **Solve an equation or formula with two variables for a particular variable.**

Example: Solve the formula $C = 2\pi r$ for r.

7.2.5 **Find the slope of a line from its graph and relate the slope of a line to similar triangles.**

Example: Draw the graph of $y = 2x - 1$. Choose two points on the graph and divide the change in y-value by the change in x-value. Repeat this for other pairs of points on the graph. What do you notice?

7.2.6 **Draw the graph of a line given either its slope and one point on the line or two points on the line.**

Example: Draw the graph of the equation with slope of 3 and passing through the point (0, -2).

7.2.7 Identify situations that involve proportional relationships, draw graphs representing these situations and recognize that these situations are described by a linear function in the form $y = mx$, where the unit rate m is the slope of the line.

Example: At a ski resort, one of the slopes rises 8 feet vertically for every 48-foot run. The second slope rises 12 feet vertically for every 72-foot run. Compare the steepness of the two slopes. Which is steeper?

Standard 3

Geometry and Measurement

CORE STANDARD

Geometry and Measurement

Transformations

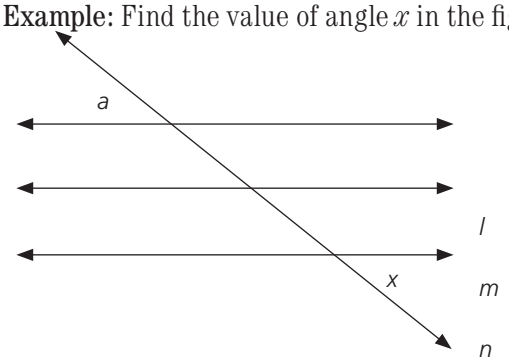
Identify and use the following transformations: translations, rotations and reflections.

[Standard Indicator: 7.3.2]

7

7.3.1 Identify and use basic properties of angles formed by transversals intersecting parallel lines.

Example: Find the value of angle x in the figure below if $m\angle a = 30°$



7.3.2 Identify, describe and use transformations (translations, rotations, reflections and simple compositions of these transformations) to solve problems.

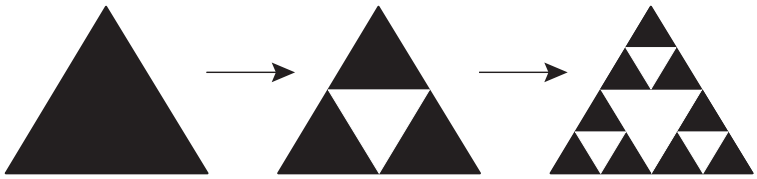
Example: Draw a triangle with vertices (2, 3), (5, 3) and (2, 7). Translate (slide) the triangle so that the vertex (2, 3) moves to (0, 0). Find the new coordinates of the other two vertices.

7.3.3 Draw two-dimensional patterns (nets) for three-dimensional objects like right prisms, pyramids, cylinders and cones.

Example: Draw a rectangle and two circles that will fit together to make a cylinder.

7.3.4 Recognize, describe or extend geometric patterns using tables, graphs, words or symbols.

Example: Look at the three triangles below. What fraction of each triangle is not shaded? Do you see a pattern? Use the pattern to predict the fraction of the triangle you would NOT shade in the fourth iteration of the triangle. Confirm your prediction and explain.



7.3.5 Identify, describe and construct similarity relationships and solve problems involving similarity (including similar triangles). Scale drawings by using proportional reasoning.

Example: At a certain time, the shadow of your school building is 36 feet long. At the same time, the shadow of a yardstick held vertically is 4 feet long. What is the height of the school building?

7.3.6 Solve simple problems involving distance, speed and time.

- Understand concepts of speed and average speed.
- Understand the relationships among distance, time and speed.
- Find speed, distance or time given the other two quantities.
- Write speed in different units (km/h, m/s, cm/s, mi/hr, ft/sec).
- Solve simple problems involving speed and average speed.

Examples:

- Find how long an airplane flying at 900 kilometers per hour takes to travel 1,350 kilometers.
- A cheetah can run 120 kilometers per hour for a short time. Give this speed in meters per second.
- Sarah drove 145 miles from Elkhart to Muncie in 2 hours and 45 minutes. Find Sarah's average speed in miles per hour.

Standard 4

Data Analysis and Probability

CORE STANDARD

Data Analysis and Probability

Making Estimates and Data Displays

Use proportions to make estimates about a population based on a sample. Create, analyze and interpret data sets in multiple ways using bar graphs, frequency tables, line plots, histograms and circle graphs.

[Standard Indicators: 7.4.1, 7.4.2]

Theoretical Probability

Understand that when all outcomes are equally likely, the theoretical probability of an event is the fraction of outcomes in which the event may occur. Use theoretical probability and proportions to make predictions.

[Standard Indicator: 7.4.5]

7.4.1 **Create, analyze and interpret data sets in multiple ways using bar graphs, frequency tables, line plots, histograms and circle graphs. Justify the choice of data display.**

Example: The students will count the value of the change in their pockets. Use the amounts collected from the class to construct a histogram. Describe the shape of the distribution.

7.4.2 **Make predictions from statistical data and use proportions to make estimates about a population based on a sample.**

Example: Record the temperature and weather conditions (sunny, cloudy or rainy) at 1 p.m. each day for two weeks. In the third week, use your results to predict the temperature from the weather conditions.

7.4.3 **Describe how additional data, particularly outliers, added to a data set may affect the mean, median and mode.**

Example: You measure the heights of the students in your grade on a day when the basketball team is playing an away game. Later you measure the players on the team and include them in your data. What kind of effect will including the team have on the mean, median and mode? Explain your answer.

7.4.4 **Analyze data displays, including ways that they can be misleading. Analyze ways in which the wording of questions can influence survey results.**

Example: A company displays a bar graph of company's sales that suggests sales have more than doubled since last year. Upon analyzing the graph, you notice that sales have in fact increased from $5.5 million to $6.2 million. Explain how the company may have used the graph to suggest that sales doubled.

7.4.5 **Understand that when all outcomes are equally likely, the theoretical probability of an event is the fraction of outcomes in which the event may occur. Use theoretical probability and proportions to make predictions.**

Example: The weather forecast says that the probability of rain today is 0.3. What is the probability that it will not rain?

PROCESS STANDARDS

Indiana's Academic Standards for Mathematics describe the key content of each grade level and course, and students must develop conceptual understanding of this content. The American Diploma Project noted that, "beyond acquiring procedural mathematical skills with their clear methods and boundaries, students need to master the more subjective skills of reading, interpreting, representing and 'mathematicizing' a problem" (p. 55).

The National Council of Teachers of Mathematics has described five Process Standards that "highlight ways of acquiring and using content knowledge" (p. 29). The following Process Standards must be addressed throughout the learning and teaching of Indiana's Academic Standards for Mathematics in all grade levels in mathematics.

Problem Solving

- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.
- Monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof

- Recognize reasoning and proof as fundamental aspects of mathematics.
- Make and investigate mathematical conjectures.
- Develop and evaluate mathematical arguments and proofs.
- Select and use various types of reasoning and methods of proof.

Communication

- Organize and consolidate mathematical thinking through communication.
- Communicate mathematical thinking coherently and clearly to peers, teachers and others.
- Analyze and evaluate the mathematical thinking and strategies of others.
- Use the language of mathematics to express mathematical ideas precisely.

Connections

- Recognize and use connections among mathematical ideas.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize and apply mathematics in contexts outside of mathematics.

Representation

- Create and use representations to organize, record and communicate mathematical ideas.
- Select, apply and translate among mathematical representations to solve problems.
- Use representations to model and interpret physical, social and mathematical phenomena.

In addition, estimation, mental computation and technology are areas that need to be addressed at all grade levels in mathematics.

Estimation and Mental Computation

- Know and apply appropriate methods for estimating the results of computations.
- Round numbers to a specified place value.
- Use estimation to decide whether answers are reasonable.
- Decide when estimation is an appropriate strategy for solving a problem.
- Determine appropriate accuracy and precision of measurements in problem situations.
- Use properties of numbers and operations to perform mental computation.
- Recognize when the numbers involved in a computation allow for a mental computation strategy.

Technology

- Technology should be used as a tool in mathematics education to support and extend the mathematics curriculum.
- Technology can contribute to concept development, simulation, representation, communication and problem solving.
- The challenge is to ensure that technology supports, but is not a substitute for, the development of skills with basic operations, quantitative reasoning and problem-solving skills.
  - Graphing calculators should be used to enhance middle school and high school students' understanding and skills.
  - The focus must be on learning mathematics and using technology as a tool rather than as an end unto itself.

References

American Diploma Project (2004). *Ready or Not: Creating a High School Diploma that Counts*. Washington, D.C.: Achieve, Inc.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston VA: author.